MULTIMEDIA UNIVERSITY

STUDENT ID NO

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SEAT NO

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VENUE:_____

# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2022/2023 (TERM ID 2210)**

## PMT0301 – MATHEMATICS III

(All sections/ Groups)

9 FEBRUARY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

| Question | Marks |
|---|---|
| 1 | /10 |
| 2 | /10 |
| 3 | /10 |
| 4 | /10 |
| 5 | /10 |
| Total | /50 |

**INSTRUCTIONS TO STUDENTS**

1. This question paper consists of **THIRTEEN** printed pages excluding cover page, formulae list and statistical table.

2. Answer **ALL** FIVE questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the **QUESTION BOOKLET**. All necessary working steps **MUST** be shown.

## Question 1

a) Mitesh purchases a condominium for RM450,000. Assume the annual appreciation is by 2% of its value in the previous year. In what year will the value of the asset be more than RM585,000? Let $n = 1$ be the year the asset is purchased.
(Note: Express your final answer in whole number). [2.5 marks]

Continue...

b) Given the following system of linear equations:

$$x+2y-z=2$$
$$x+z=0$$
$$2x-y-z=-5$$

Find the inverse matrix by using its adjoint, and hence solve the system of linear equations by using inverse method. [7.5 marks]

Continue...

## Question 2

a) Determine whether the expression is meaningful or not. [1.5 marks]

| No. | Expressions | Answer (Yes/ No) |
|---|---|---|
| i | $\lvert\mathbf{a}-\mathbf{b}\rvert+(\mathbf{c}+3\mathbf{d})$ | |
| ii | $(2\mathbf{a}-\mathbf{b})\cdot 5(\mathbf{c}+3\mathbf{d})$ | |
| iii | $(\mathbf{a}\times\mathbf{b})\times(\mathbf{c}+\mathbf{d})$ | |

b) Find the angle between the planes $2x-y-3z=-9$ and $-x+3y+z=8$. [3 marks]

Continue…

c) Find the parametric equation for a line passing through $(5,-1,2)$ and orthogonal to both $\mathbf{i}+\mathbf{k}$ and $\mathbf{j}-2\mathbf{k}$. [3.5 marks]

Continue...

d) Find an equation of the plane that contains the line $x = 2-3t$, $y = -2+t$, $z = -1+2t$ and is parallel to the plane $2x-3y+z=2$. Give your final answer in the form of $ax+by+cz=d$. [2 marks]

Continue...

**Question 3**

Table below shows the daily working hours from a random **sample** of 30 freelancer in Cyberjaya.

| Class Limit | Frequency |
|---|---|
| 1 – 5 | 4 |
| 6 – 10 | 6 |
| 11 – 15 | 10 |
| 16 – 20 | 5 |
| 21 – 25 | 5 |

a) Calculate the mean. Correct your answer to 2 decimal places. [1.5 marks]

b) Calculate the median. [2 marks]

Continue…

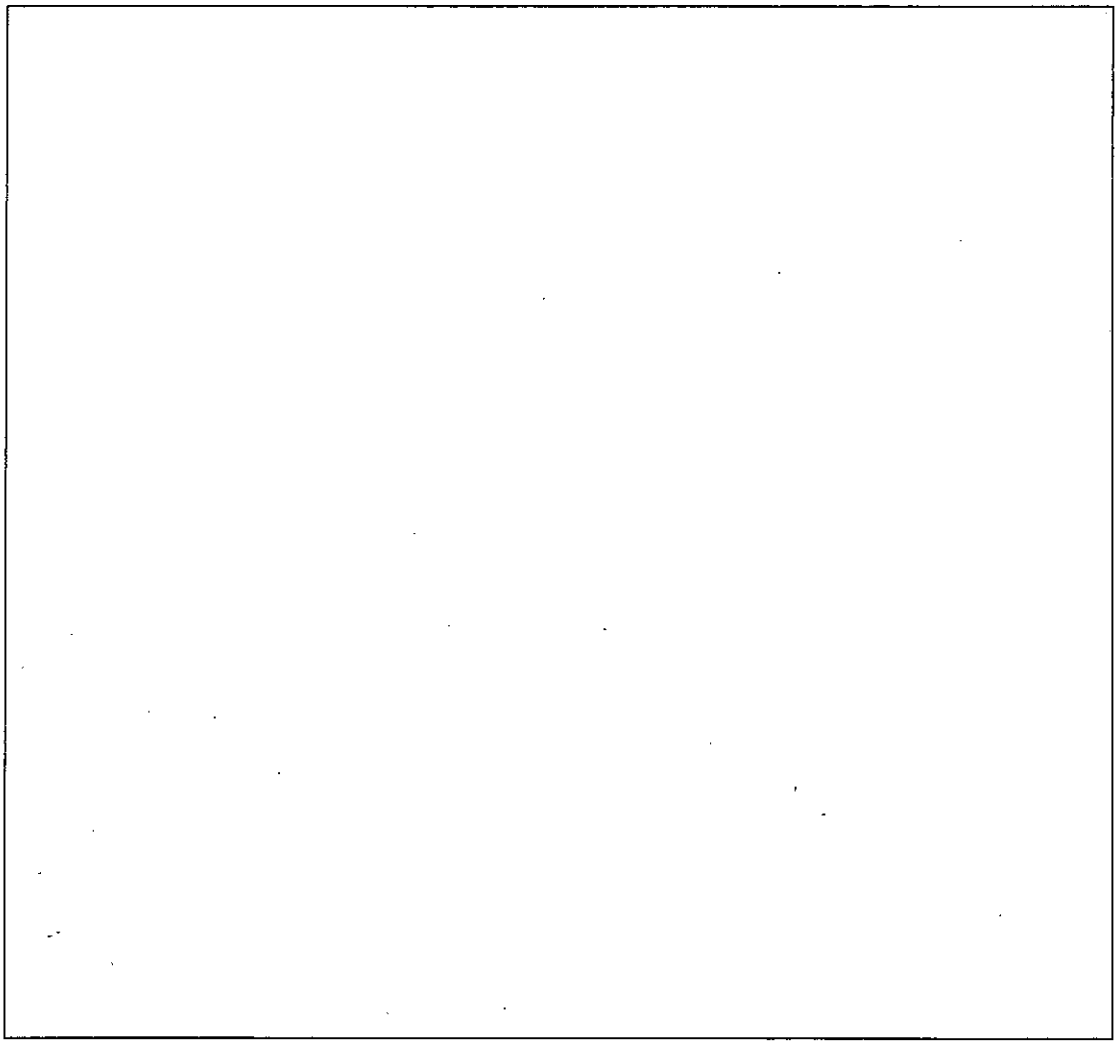
c) Calculate the mode. Correct your answer to 2 decimal places. [2 marks]

d) Describe the shape of the distribution of above data. Explain your answer. [1 mark]

e) Calculate the standard deviation. Give your answer correct to 2 decimal places. [2 marks]

Continue...

f) Sketch a histogram to visualize the distribution of the daily working hours. [1.5 marks]



Continue...

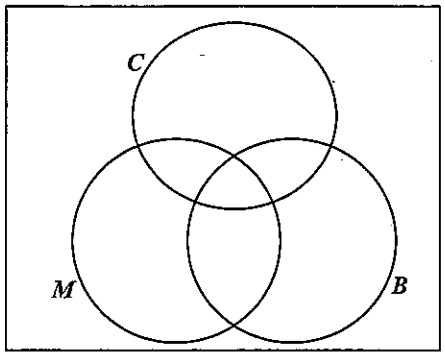
**Question 4**

a) 250 FCI Foundation students attended at least one of the three seminars organized by the I.T. Society during the midterm break of the semester,

150 signed up into Cryptography,
128 signed up into Machine Learning,
133 signed up into Big Data,
68 signed up into both Cryptography and Big Data,
61 signed up into both Cryptography and Machine Learning,
50 signed up into both Machine Learning and Big Data,
and 18 signed up into all three short courses.

Let $C$ be the event for the seminar on Cryptography, $M$ for Machine Learning, and $B$ for Big Data.

i) Represent the above information in a Venn diagram. [2 marks]




ii) If a student is selected at random, find the probability that a student attended exactly two seminars. [1 mark]

Continue…

iii)If a student is selected at random, find the probability given that a student attended Cryptography will attend at least two seminars. [1.5 marks]

b) How many possible 6-letters words can be formed from the letters of the word **PROGRAMMING** if the second letter must be a 'A'? [1.5 marks]

Continue...

c) Given $A = \{1, 4, 6, 8, 9, 11, 17\}$ and $B = \{1, 2, 3, 4, 6, 8, 13\}$,

i) Are events $A$ and $B$ mutually exclusive events? Explain your answer. [1.5 marks]

ii) Are events $A$ and $B$ statistically independent? Explain your answer. (2.5 marks)

Continue...

## Question 5

a) A university student, Peter, often misses the 9am class due to overslept. The probability that he will oversleep is 0.55. If there are fourteen 9am classes in the entire semester, find the

i) probability that he will be missing between 7 and 10 classes. [2 marks]

ii) mean and standard deviation of the number of times he will **NOT** miss the class. [2 marks]

Continue...

b) The number of surface flaws on a marble table has a Poisson distribution with an average of three flaws for an area of $20m^2$. Find the probability that four marble tables, each with the size of $2.5m \times 1.5m$, will contain a total of at least three flaws. [3 marks]

c) The lifespan of a computer is normally distributed with an average of 15 years and a variance of 4 years. Find the percentage that the lifespan of any given computer is less than the population mean by 5 years or more. [3 marks]

**The End**

# FORMULAE LIST

## Sequences and Series

Arithmetic Sequences:

$$T_n = a+(n-1)d\ ;\ S_n = \frac{n}{2}\left[2a+(n-1)d\right]$$

Geometric Sequences:

$$T_n = ar^{n-1}\ ;\ S_n = \frac{a\left(1-r^n\right)}{1-r}\ ;\ S_\infty = \frac{a}{1-r}$$

Binomial Theorem:

$$(a+b)^n = \binom{n}{0}a^n b^0 + \binom{n}{1}a^{n-1}b^1 + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{k}a^{n-k}b^k + \ldots + \binom{n}{n}a^0 b^n$$

## Vector

Dot Product:

$$\mathbf{u}\cdot\mathbf{v} = u_1v_1 + u_2v_2 + u_3v_3 \quad \text{or} \quad \mathbf{u}\cdot\mathbf{v} = \|\mathbf{u}\|\,\|\mathbf{v}\|\cos\theta$$

Cross Product:

$$\mathbf{u}\times\mathbf{v} = \begin{vmatrix}\mathbf{i} & \mathbf{j} & \mathbf{k}\\ u_1 & u_2 & u_3\\ v_1 & v_2 & v_3\end{vmatrix} = \begin{vmatrix}u_2 & u_3\\ v_2 & v_3\end{vmatrix}\mathbf{i} - \begin{vmatrix}u_1 & u_3\\ v_1 & v_3\end{vmatrix}\mathbf{j} + \begin{vmatrix}u_1 & u_2\\ v_1 & v_2\end{vmatrix}\mathbf{k}$$

Line Equation in 3D space:

$$\mathbf{r} = \mathbf{r}_0 + t\mathbf{v}$$

Plane Equation in 3D space:

$$\mathbf{n}.(\mathbf{r}-\mathbf{r}_0) = 0$$

Measures of Central Tendency:

| Mean | | | |
|---|---|---|---|
| Ungrouped Data | | Grouped Data | |
| Sample | Population | Sample | Population |
| $\bar{x} = \frac{\sum x}{n}$ | $\mu = \frac{\sum x}{N}$ | $\bar{x} = \frac{\sum mf}{\sum f}$ | $\mu = \frac{\sum mf}{\sum f}$ |

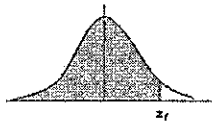
$$\text{Mode} = L + \left[\frac{f_m - f_B}{(f_m - f_A)+(f_m - f_B)}\right]c \qquad \text{Median} = L + \left(\frac{\frac{\sum f}{2} - f_L}{f_m}\right)c$$

Variance:

| Ungrouped Data | | Grouped Data | |
|---|---|---|---|
| Sample | Population | Sample | Population |
| $s^2 = \frac{\sum x^2 - \frac{\left(\sum x\right)^2}{n}}{n-1}$ | $\sigma^2 = \frac{\sum x^2 - \frac{\left(\sum x\right)^2}{N}}{N}$ | $s^2 = \frac{\sum m^2 f - \frac{\left(\sum mf\right)^2}{\sum f}}{\sum f - 1}$ | $s^2 = \frac{\sum m^2 f - \frac{\left(\sum mf\right)^2}{\sum f}}{\sum f}$ |

| | |
|---|---|
| Conditional Probability | $P(A\|B) = \frac{P(A\cap B)}{P(B)}$ |
| Independent Event | $P(A\|B) = P(A)$ or $P(B\|A) = P(B)$ or $P(A\cap B) = P(A)\cdot P(B)$ |
| Binomial Distribution | $P(X=x) = \binom{n}{x}p^x q^{n-x}\ ;\ \mu = np\ ;\ \sigma = \sqrt{npq}$ |
| Poisson Distribution | $P(X=x) = \frac{\lambda^x e^{-\lambda}}{x!}\ ;\ \mu = \lambda\ ;\ \sigma = \sqrt{\lambda}$ |
| Normal Distribution | $z = \frac{x-\mu}{\sigma}$ |

## Standard Normal Distribution




$$p(z \le z_1) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z_1} e^{-\frac{1}{2}z^2} dz$$

**The Normal Distribution Function**

| x | Φ(x) | x | Φ(x) | x | Φ(x) | x | Φ(x) |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.5000 | 0.50 | 0.6915 | 1.00 | 0.8413 | 1.50 | 0.9332 |
| 0.01 | 0.5040 | 0.51 | 0.6950 | 1.01 | 0.8438 | 1.51 | 0.9345 |
| 0.02 | 0.5080 | 0.52 | 0.6985 | 1.02 | 0.8461 | 1.52 | 0.9357 |
| 0.03 | 0.5120 | 0.53 | 0.7019 | 1.03 | 0.8485 | 1.53 | 0.9370 |
| 0.04 | 0.5160 | 0.54 | 0.7054 | 1.04 | 0.8508 | 1.54 | 0.9382 |
| 0.05 | 0.5199 | 0.55 | 0.7088 | 1.05 | 0.8531 | 1.55 | 0.9394 |
| 0.06 | 0.5239 | 0.56 | 0.7123 | 1.06 | 0.8554 | 1.56 | 0.9406 |
| 0.07 | 0.5279 | 0.57 | 0.7157 | 1.07 | 0.8577 | 1.57 | 0.9418 |
| 0.08 | 0.5319 | 0.58 | 0.7190 | 1.08 | 0.8599 | 1.58 | 0.9429 |
| 0.09 | 0.5359 | 0.59 | 0.7224 | 1.09 | 0.8621 | 1.59 | 0.9441 |
| 0.10 | 0.5398 | 0.60 | 0.7257 | 1.10 | 0.8643 | 1.60 | 0.9452 |
| 0.11 | 0.5438 | 0.61 | 0.7291 | 1.11 | 0.8665 | 1.61 | 0.9463 |
| 0.12 | 0.5478 | 0.62 | 0.7324 | 1.12 | 0.8686 | 1.62 | 0.9474 |
| 0.13 | 0.5517 | 0.63 | 0.7357 | 1.13 | 0.8708 | 1.63 | 0.9484 |
| 0.14 | 0.5557 | 0.64 | 0.7389 | 1.14 | 0.8729 | 1.64 | 0.9495 |
| 0.15 | 0.5596 | 0.65 | 0.7422 | 1.15 | 0.8749 | 1.65 | 0.9505 |
| 0.16 | 0.5636 | 0.66 | 0.7454 | 1.16 | 0.8770 | 1.66 | 0.9515 |
| 0.17 | 0.5675 | 0.67 | 0.7486 | 1.17 | 0.8790 | 1.67 | 0.9525 |
| 0.18 | 0.5714 | 0.68 | 0.7517 | 1.18 | 0.8810 | 1.68 | 0.9535 |
| 0.19 | 0.5753 | 0.69 | 0.7549 | 1.19 | 0.8830 | 1.69 | 0.9545 |
| 0.20 | 0.5793 | 0.70 | 0.7580 | 1.20 | 0.8849 | 1.70 | 0.9554 |
| 0.21 | 0.5832 | 0.71 | 0.7611 | 1.21 | 0.8869 | 1.71 | 0.9564 |
| 0.22 | 0.5871 | 0.72 | 0.7642 | 1.22 | 0.8888 | 1.72 | 0.9573 |
| 0.23 | 0.5910 | 0.73 | 0.7673 | 1.23 | 0.8907 | 1.73 | 0.9582 |
| 0.24 | 0.5948 | 0.74 | 0.7704 | 1.24 | 0.8925 | 1.74 | 0.9591 |
| 0.25 | 0.5987 | 0.75 | 0.7734 | 1.25 | 0.8944 | 1.75 | 0.9599 |
| 0.26 | 0.6026 | 0.76 | 0.7764 | 1.26 | 0.8962 | 1.76 | 0.9608 |
| 0.27 | 0.6064 | 0.77 | 0.7794 | 1.27 | 0.8980 | 1.77 | 0.9616 |
| 0.28 | 0.6103 | 0.78 | 0.7823 | 1.28 | 0.8997 | 1.78 | 0.9625 |
| 0.29 | 0.6141 | 0.79 | 0.7852 | 1.29 | 0.9015 | 1.79 | 0.9633 |
| 0.30 | 0.6179 | 0.80 | 0.7881 | 1.30 | 0.9032 | 1.80 | 0.9641 |
| 0.31 | 0.6217 | 0.81 | 0.7910 | 1.31 | 0.9049 | 1.81 | 0.9649 |
| 0.32 | 0.6255 | 0.82 | 0.7939 | 1.32 | 0.9066 | 1.82 | 0.9656 |
| 0.33 | 0.6293 | 0.83 | 0.7967 | 1.33 | 0.9082 | 1.83 | 0.9664 |
| 0.34 | 0.6331 | 0.84 | 0.7995 | 1.34 | 0.9099 | 1.84 | 0.9671 |
| 0.35 | 0.6368 | 0.85 | 0.8023 | 1.35 | 0.9115 | 1.85 | 0.9678 |
| 0.36 | 0.6406 | 0.86 | 0.8051 | 1.36 | 0.9131 | 1.86 | 0.9686 |
| 0.37 | 0.6443 | 0.87 | 0.8078 | 1.37 | 0.9147 | 1.87 | 0.9693 |
| 0.38 | 0.6480 | 0.88 | 0.8106 | 1.38 | 0.9162 | 1.88 | 0.9699 |
| 0.39 | 0.6517 | 0.89 | 0.8133 | 1.39 | 0.9177 | 1.89 | 0.9706 |
| 0.40 | 0.6554 | 0.90 | 0.8159 | 1.40 | 0.9192 | 1.90 | 0.9713 |
| 0.41 | 0.6591 | 0.91 | 0.8186 | 1.41 | 0.9207 | 1.91 | 0.9719 |
| 0.42 | 0.6628 | 0.92 | 0.8212 | 1.42 | 0.9222 | 1.92 | 0.9726 |
| 0.43 | 0.6664 | 0.93 | 0.8238 | 1.43 | 0.9236 | 1.93 | 0.9732 |
| 0.44 | 0.6700 | 0.94 | 0.8264 | 1.44 | 0.9251 | 1.94 | 0.9738 |
| 0.45 | 0.6736 | 0.95 | 0.8289 | 1.45 | 0.9265 | 1.95 | 0.9744 |
| 0.46 | 0.6772 | 0.96 | 0.8315 | 1.46 | 0.9279 | 1.96 | 0.9750 |
| 0.47 | 0.6808 | 0.97 | 0.8340 | 1.47 | 0.9292 | 1.97 | 0.9756 |
| 0.48 | 0.6844 | 0.98 | 0.8365 | 1.48 | 0.9306 | 1.98 | 0.9761 |
| 0.49 | 0.6879 | 0.99 | 0.8389 | 1.49 | 0.9319 | 1.99 | 0.9767 |
| 0.50 | 0.6915 | 1.00 | 0.8413 | 1.50 | 0.9332 | 2.00 | 0.9772 |

| x | Φ(X) | x | Φ(X) | x | Φ(X) | x | Φ(X) |
|---|---|---|---|---|---|---|---|
| 2.00 | 0.97725 | 2.50 | 0.99379 | 3.00 | 0.99865 | 3.50 | 0.99977 |
| 2.01 | 0.97778 | 2.51 | 0.99396 | 3.01 | 0.99869 | 3.51 | 0.99978 |
| 2.02 | 0.97831 | 2.52 | 0.99413 | 3.02 | 0.99874 | 3.52 | 0.99978 |
| 2.03 | 0.97882 | 2.53 | 0.99430 | 3.03 | 0.99878 | 3.53 | 0.99979 |
| 2.04 | 0.97932 | 2.54 | 0.99446 | 3.04 | 0.99882 | 3.54 | 0.99980 |
| 2.05 | 0.97982 | 2.55 | 0.99461 | 3.05 | 0.99886 | 3.55 | 0.99981 |
| 2.06 | 0.98030 | 2.56 | 0.99477 | 3.06 | 0.99889 | 3.56 | 0.99981 |
| 2.07 | 0.98077 | 2.57 | 0.99492 | 3.07 | 0.99893 | 3.57 | 0.99982 |
| 2.08 | 0.98124 | 2.58 | 0.99506 | 3.08 | 0.99896 | 3.58 | 0.99983 |
| 2.09 | 0.98169 | 2.59 | 0.99520 | 3.09 | 0.99900 | 3.59 | 0.99983 |
| 2.10 | 0.98214 | 2.60 | 0.99534 | 3.10 | 0.99903 | 3.60 | 0.99984 |
| 2.11 | 0.98257 | 2.61 | 0.99547 | 3.11 | 0.99906 | 3.61 | 0.99985 |
| 2.12 | 0.98300 | 2.62 | 0.99560 | 3.12 | 0.99910 | 3.62 | 0.99985 |
| 2.13 | 0.98341 | 2.63 | 0.99573 | 3.13 | 0.99913 | 3.63 | 0.99986 |
| 2.14 | 0.98382 | 2.64 | 0.99585 | 3.14 | 0.99916 | 3.64 | 0.99986 |
| 2.15 | 0.98422 | 2.65 | 0.99598 | 3.15 | 0.99918 | 3.65 | 0.99987 |
| 2.16 | 0.98461 | 2.66 | 0.99609 | 3.16 | 0.99921 | 3.66 | 0.99987 |
| 2.17 | 0.98500 | 2.67 | 0.99621 | 3.17 | 0.99924 | 3.67 | 0.99988 |
| 2.18 | 0.98537 | 2.68 | 0.99632 | 3.18 | 0.99926 | 3.68 | 0.99988 |
| 2.19 | 0.98574 | 2.69 | 0.99643 | 3.19 | 0.99929 | 3.69 | 0.99989 |
| 2.20 | 0.98610 | 2.70 | 0.99653 | 3.20 | 0.99931 | 3.70 | 0.99989 |
| 2.21 | 0.98645 | 2.71 | 0.99664 | 3.21 | 0.99934 | 3.71 | 0.99990 |
| 2.22 | 0.98679 | 2.72 | 0.99674 | 3.22 | 0.99936 | 3.72 | 0.99990 |
| 2.23 | 0.98713 | 2.73 | 0.99683 | 3.23 | 0.99938 | 3.73 | 0.99990 |
| 2.24 | 0.98745 | 2.74 | 0.99693 | 3.24 | 0.99940 | 3.74 | 0.99991 |
| 2.25 | 0.98778 | 2.75 | 0.99702 | 3.25 | 0.99942 | 3.75 | 0.99991 |
| 2.26 | 0.98809 | 2.76 | 0.99711 | 3.26 | 0.99944 | 3.76 | 0.99992 |
| 2.27 | 0.98840 | 2.77 | 0.99720 | 3.27 | 0.99946 | 3.77 | 0.99992 |
| 2.28 | 0.98870 | 2.78 | 0.99728 | 3.28 | 0.99948 | 3.78 | 0.99992 |
| 2.29 | 0.98899 | 2.79 | 0.99736 | 3.29 | 0.99950 | 3.79 | 0.99992 |
| 2.30 | 0.98928 | 2.80 | 0.99744 | 3.30 | 0.99952 | 3.80 | 0.99993 |
| 2.31 | 0.98956 | 2.81 | 0.99752 | 3.31 | 0.99953 | 3.81 | 0.99993 |
| 2.32 | 0.98983 | 2.82 | 0.99760 | 3.32 | 0.99955 | 3.82 | 0.99993 |
| 2.33 | 0.99010 | 2.83 | 0.99767 | 3.33 | 0.99957 | 3.83 | 0.99994 |
| 2.34 | 0.99036 | 2.84 | 0.99774 | 3.34 | 0.99958 | 3.84 | 0.99994 |
| 2.35 | 0.99061 | 2.85 | 0.99781 | 3.35 | 0.99960 | 3.85 | 0.99994 |
| 2.36 | 0.99086 | 2.86 | 0.99788 | 3.36 | 0.99961 | 3.86 | 0.99994 |
| 2.37 | 0.99111 | 2.87 | 0.99795 | 3.37 | 0.99962 | 3.87 | 0.99995 |
| 2.38 | 0.99134 | 2.88 | 0.99801 | 3.38 | 0.99964 | 3.88 | 0.99995 |
| 2.39 | 0.99158 | 2.89 | 0.99807 | 3.39 | 0.99965 | 3.89 | 0.99995 |
| 2.40 | 0.99180 | 2.90 | 0.99813 | 3.40 | 0.99966 | 3.90 | 0.99995 |
| 2.41 | 0.99202 | 2.91 | 0.99819 | 3.41 | 0.99968 | 3.91 | 0.99995 |
| 2.42 | 0.99224 | 2.92 | 0.99825 | 3.42 | 0.99969 | 3.92 | 0.99996 |
| 2.43 | 0.99245 | 2.93 | 0.99831 | 3.43 | 0.99970 | 3.93 | 0.99996 |
| 2.44 | 0.99266 | 2.94 | 0.99836 | 3.44 | 0.99971 | 3.94 | 0.99996 |
| 2.45 | 0.99286 | 2.95 | 0.99841 | 3.45 | 0.99972 | 3.95 | 0.99996 |
| 2.46 | 0.99305 | 2.96 | 0.99846 | 3.46 | 0.99973 | 3.96 | 0.99996 |
| 2.47 | 0.99324 | 2.97 | 0.99851 | 3.47 | 0.99974 | 3.97 | 0.99996 |
| 2.48 | 0.99343 | 2.98 | 0.99856 | 3.48 | 0.99975 | 3.98 | 0.99997 |
| 2.49 | 0.99361 | 2.99 | 0.99861 | 3.49 | 0.99976 | 3.99 | 0.99997 |
| 2.50 | 0.99379 | 3.00 | 0.99865 | 3.50 | 0.99977 | 4.00 | 0.99997 |